

REMARKS

Reexamination and reconsideration in light of the foregoing amendments and the following remarks is respectfully requested.

Claims 1-20 are pending in this application. Claims 19 and 20 have been withdrawn from consideration due to a restriction requirement. Applicants acknowledge the election of claims of Group I, claims 1-18. Applicants appreciate the Examiner's indication that claims 5, 9 and 11 contain allowable subject matter if rewritten in independent form. These claims have been rewritten in independent form. In addition, claims 11, 13 and 17 have been amended. Support for the amendments can be found at page 2, lines 11-16; page 10, lines 1-21; Figs. 4F, 4G and 4H; page 21, lines 30-35; and original claim 8.

Applicants note the Examiner's consideration of the documents cited in the Information Disclosure Statement filed March 27, 2001 as acknowledged in the Office Action Summary. Applicants further note the Examiner's acknowledgment of Applicants' claim for foreign priority under 35 U.S.C. § 119 and receipt of the certified priority document.

OBJECTION TO THE TITLE

The Examiner objected to the title of the invention. The title has been changed to "METHOD FOR MANUFACTURING SILICON CARBIDE DEVICE USING WATER RICH ANNEAL." It is believed that the new title is now descriptive of the claimed invention. It is respectfully requested that the Examiner approve the amendment of the title.

REJECTION UNDER 35 U.S.C. § 103 UNDER TYAGI AND UENO

Claims 1-4, 6-8 and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tyagi et al. in view of Ueno (U.S. Patent No. 6,265,326 B1).

Before addressing the specific distinction between the claimed invention and the cited references, the following is a brief description of the invention. The present invention is directed to a method of forming a thermal oxide film above a SiC substrate. One of the features of the present invention is a process for forming a silicon oxide film on the surface of the SiC substrate so as to provide a desired high performance of the SiC device. To that end, the claimed method as set forth in claim 1 embraces the steps of (a) depositing a silicon film above a SiC substrate, (b) delineating the silicon film into required pattern so as to expose a surface of the SiC substrate, and (c) annealing the SiC substrate in a water rich ambient to selectively grow a localized thermal oxide film above the SiC substrate.

The Tyagi et al. reference does not disclose or suggest the claimed step of delineating the silicon film into required pattern so as to expose a surface of the SiC substrate. On page 2189, right column to page 2191, left column of the reference, "The Field-Poly Process" is disclosed with reference to Fig. 4. As shown in Fig. 4 (a), the surface of the 6H-SiC substrate is covered by a polysilicon which is selectively oxidized to form a thin sacrificial oxide layer. A silicon nitride layer is deposited on the sacrificial oxide layer. The nitride layer, and not the polysilicon layer, is delineated to form a required pattern as shown in Fig. 4(b) so as to provide thick field oxide films as shown in Fig. 4 (c) upon annealing in a steam ambient. Accordingly, Tyagi et al. does not disclose or suggest delineating the polysilicon or a silicon film as required by claim 1 and the claims dependent thereon.

Fig. 4 (d) of Tyagi et al. shows that the thin pad oxide film at the central portion or active region of the device was protected from oxidation by the silicon nitride layer. The central portion shown in Fig. 4 (c) is configured to be surrounded by the thick field oxide film so as to provide isolating field region. "The Field-Poly Process" of the Tyagi et al. reference requires that the surface of the 6H-SiC substrate must be covered by the polysilicon. There is no teaching of delineating the polysilicon to expose the surface of the SiC substrate before annealing in a water rich ambient to selectively grow a localized thermal oxide film above the SiC substrate. Tyagi et al. discloses the use of a silicon nitride layer over the active area to selectively oxidize the pad oxide, polysilicon and sacrificial oxide layers into the field oxide layers shown in Fig. 4(c). In contrast to the invention disclosed herein, the silicon film is removed so as to expose the surface of the SiC substrate. See Figs. 4F to 4L in the present specification.

For all of the foregoing reasons, Tyagi et al substantially differs from claimed method. The Ueno reference fails to make up for the deficiencies of Tyagi et al. Examiner relies on Ueno as teaching thermally growing an oxide layer in the water rich ambient, wherein the H₂O partial pressure in the water rich ambient is in the range of 0.1 to 0.95. Ueno does not cure the deficiencies in Tyagi et al., since both reference fail to show claimed step of delineating the silicon film into required pattern so as to expose a surface of the SiC substrate. Ueno would not have provided any motivation for a person having ordinary skill in the art to modify the method of Tyagi et al. to delineate the silicon film so as to expose the surface of the SiC substrate as required by claim 1 and the claims dependent thereon. Thus, the proposed combination of Ueno and Tyagi et al. would not have led such a person to the claimed invention.

Accordingly, the Examiner has not made out a *prima facie* case of obviousness. It is respectfully requested that the rejection of claims 1-4, 6-8 and 10 be reconsidered and withdrawn.

REJECTION UNDER 35 U.S.C. § 103 UNDER PALMOUR AND UENO

Claims 13-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Palmour (U.S. Patent No. 5,459,107) in view of Ueno (U.S. Patent No. 6,265,326 B1). Applicant's invention, as recited in claim 13, is directed to a method for manufacturing the SiC device capable of providing an improved gate oxide film, embracing smaller interface state densities. To that end, the claimed method comprises the steps of (a) forming a gate oxide film on a surface of a SiC substrate and (b) annealing claimed gate oxide film in a water rich ambient at substrate temperature equal to or lower than the substrate temperature at which the gate oxide film is formed so as to reduce interface density between claimed gate oxide film and claimed SiC substrate. The Examiner concedes that Palmour fails to disclose or suggest the step of annealing the claimed gate oxide film in a water rich ambient at a substrate temperature equal to or lower than the substrate temperature at which the gate oxide film is formed. For this deficiency, the Examiner relies on the teachings of Ueno.

Ueno does not disclose or suggest the claimed step of annealing the gate oxide film in a water rich ambient at a substrate temperature equal to or lower than the substrate temperature at which the gate oxide film is formed so as to reduce interface density between the gate oxide film and the SiC substrate. As pointed out by the Examiner, Ueno teach forming a thermal oxide layer on a SiC substrate. The oxide formed by Ueno is not disclosed to function as a gate oxide. Further, there is no teaching of forming a gate oxide following by the annealing step in a water rich ambient as required by claim 13. Ueno simply does not disclose or suggest the annealing

step after the oxide layer is formed. Moreover, there is no teaching or suggestion by either Palmour or Ueno that annealing a gate oxide film as required by claim 13 will reduce the interface density between the gate oxide film and the SiC substrate.

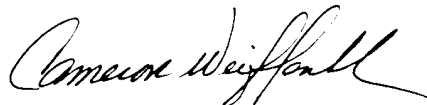
For the foregoing reasons, the combined teachings of Palmour and Ueno do not establish a *prima facie* case of obviousness. Accordingly, it is respectfully requested that the rejection of claims 13-18 be reconsidered and withdrawn.

CONCLUSION

It is submitted that the claims 1-18 are patentable over the combined teachings of the prior art relied upon by the Examiner. Accordingly, favorable reconsideration of the claims is requested in light of the preceding amendments and remarks. Allowance of the claims is courteously solicited.

To the extent necessary, a petition for an extension of time under 37 CFR 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,
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